Tune, Lube, or Brake: An Economic Analysis of Mobile Source Emission Policies in the Georgia Basin/Puget Sound Transboundary Airshed

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Abstract

Since the late 1980s, there's been a growing realization that the Pacific Northwest is a transboundary ecosystem. While humans have created two countries, the region has remained one interdependent ecosystem. As such, there is a need for international cooperation in order to protect the region as a whole. To this end, the Environmental Protection Agency (EPA) and Environment Canada (EC) have signed a Statement of Cooperation on the Georgia Basin and Puget Sound Ecosystem; this statement is to be the precursor to an international airshed strategy. There is a need for an analysis of potential policies for pollutant reduction; I intend to provide this using both an econometric and a cost-benefit analysis.

It has been determined that the specific pollutants in question – SOx, NOx, VOx, and CO – create varied and numerous effects on human mortality and morbidity, ranging from increased lung cancer incidence to harsher asthmatic attacks. Valuation studies have also determined effects on tourism, forest productivity, and ecosystem viability as a result of air pollution. These effects shall be monetized and input as the benefits of a pollution reduction policy. Costs shall include operating, regulatory, and enforcement issues of the relevant parties. Costs and benefits shall be calculated for three different policy actions: tradable permits, regulations, and conservation efforts. We believe that a combination of tradable permits and conservation will be the most cost-effective.

The second component is one of political economy; namely addressing the question of why society has allowed significant reductions in efficiency from to air pollution. An econometric analysis of this specific region shall show the spillover effects of any open access good, providing the groundwork for a formal discussion of the problem.

Transboundary air pollution between the United States and Canada has been a subject of debate throughout the last few years. The 1991 Canada-United States Air Quality Agreement, as well as its corollary Ozone Annex, have contributed greatly to the air quality in these two nations. However, given the projected boom in population growth within the Northwest, environmental planners in Washington State and British Columbia have begun work on an airshed plan for the region. The plan includes, among other things, an exploration of policy options to control regional air quality. Included in this analysis is a study of the economic factors of each option. This report examines these economic factors and recommends cost-effective strategies.

Air pollution policies fall under two categories: those implemented at the national level and those implemented at the provincial or state level. The United States system greatly favors the implementation of policy at the national level; the Canadian government allows provinces the main regulatory power. These policies include, but are not limited to, the United States Clean Air Act Amendments (CAAA) of 1990; British Columbia's Greater Vancouver Regional District Air Management Strategy of 1994; and the already established transboundary agreements between the two nations.

Socioeconomic and emissions data indicate a large increase in populations and mobile source emissions within the next 20 years. Due to these projections, this report analyzes only mobile-source specific policy options. An important caveat is that, while these policies are mainly directed at on-road vehicle emissions, they can also be easily adapted to marine emissions, an area of major concern within the Georgia Basin/Puget Sound Airshed.

We begin our analysis with a general exploration of environmental economics. The fundamental levels of policy analysis are efficiency, cost-effectiveness, equity, incentives for improvement, enforceability, and situational information.

General observations can be drawn through an understanding of six mobile source-specific policies: enhanced inspection and maintenance (I/M), emissions taxes, gas taxes, scrappage schemes, tradable emissions permits, and conservation marketing. These observations include:

Enhanced I/M policies may have serious inequity effects depending upon the implementation plan. These policies have been shown to be very effective in reducing overall emissions in the area. Case studies have shown average reductions of:

- 13% reduction of HC emitted
- 13% reduction of CO emitted
- 8% reduction of NOx emitted

These reductions have also been made at very low cost. Estimates of cost per ton of pollutant reduced are:

- US$2,281-US$2,379 per ton of HC reduced
- US$166-US$173 per ton of CO reduced
- US$2,266-US$2,363 per ton of NOx reduced

Emissions taxes, as conceived by economists, are too costly to be feasible. However, policies can be combined to mimic these emissions taxes. The best combination is a weight-distance fee. This specific policy has not been realized yet in emission control; however, distance-based insurance rates have been implemented in the United States. While projections of total emission reductions depend upon the actual fee itself, there are two general categories of emission fees: a $40-$400 fee and a $10-$1,100 fee. The following emission reduction figures are quoted for a $40-$400 fee; a $10-$1,100 fee would more than double the projections.

- 7.4-9.5% reduction of VOC
- 7.5-9.6% reduction of CO
- 6.6-8.5% reduction of NOx

The costs of a distance-based fee also depend upon the specific fee amount. Due to the small amount of data on this option, estimates of cost per ton of pollutant reduced have not yet been formed; however, given the economic theory behind this option, we can assume that the costs will be comparable, and most likely lower, than the other policy options.

Gas taxes are the easiest of all of the policies to implement. Because a gas tax already exists in the area, the only needed implementation would be a mandated increase. However, in terms of political feasibility, gas taxes are among the least desirable policy option. Citizens of North America are accustomed to low gas prices, and are not inclined to vote for higher gas taxes. Gas taxes also rank among the lowest of the policies in terms of environmental effectiveness. Projections of emission abatement as a result of gas taxes are:

- 2.2-2.7% VOC decrease with a US$0.50 per gallon gas tax increase; 7.8-9.5% VOC decrease with a US$2.00 per gallon gas tax increase
- 2.1-2.7% CO decrease with a US$0.50 per gallon increase; 7.6-9.4% CO decrease with a US$2.00 per gallon increase
- 2.1-2.5% NOx decrease with a US$0.50 per gallon increase; 7.8-9.2% NOx decrease with a US$2.00 per gallon increase

Given that the current gas tax system is not viewed as an emission reduction strategy – it is more of a user fee – specific cost estimates cannot be made. However, these costs should be low and most likely lower than the emissions taxes, due to the fact that gas taxes are already utilized in the transportation system.

Scrappage schemes have been the most frequently used policy under consideration, and therefore have the most assured consequences. Depending upon the specific implementation, scrappage schemes can have various equity problems. For example, a program that pays cash for replacement (where a certain replacement vehicle is mandated by the policy) will give more money to wealthy households than a cash-for-scrappage (no requirement is made on the replacement vehicle) scheme.

Environmental effectiveness can be assured by one of four ways: ensuring that scrapped vehicles are of the "gross emitter" category—this is best done by making only those vehicles that have recently failed I/M tests available for scrappage; mandating very clean cars as replacement vehicles and/or differentiating bonuses based upon the replacement vehicle; ensuring that the remaining lifetime of the scrapped vehicle is large; and scrapping a lot of vehicles. It is important to note that the first two methods are mutually exclusive. That is, policy-makers must decide between a cash-for-scrappage *or* a cash-for-replacement scheme. It has been demonstrated that cash-for-scrappage schemes are not only the most cost-effective, but they have the largest impact on emission reductions.
Cash-for-scrappage schemes have averaged costs of:

- US$3,500-US$4,700 per ton of HC reduced
- US$600 per ton of CO reduced
- US$18,000 to US$21,000 per ton of NOx reduced

Conservation marketing can and has been employed as an emission reduction strategy within both nations. British Columbia and Washington State have implemented these policies to good result. Specific emission reduction and cost-effectiveness of these programs depends upon implementation and the area of interest; however, it is suggested that conservation marketing is the single most cost-effective way of decreasing emissions.

Tradable emission permits are essentially a combination of enhanced I/M, scrappage, and conservation marketing. In this scheme, companies and/or local governments are given the freedom to decide how to control emissions; credits are given for the emission reductions achieved. Emission reductions can be achieved through a credit buyback scheme or an unequal credit distribution (e.g. 1 credit for every 1.5 tons of pollutant reduced). The environmental effectiveness and cost-effectiveness of this scheme depends upon the specific program chosen for implementation; these projections are given above. However, given the increased flexibility of this scheme, it is assumed that costs will be lower overall for a tradable emission permit policy.

These summaries provide a good basis for recommendations. Using the knowledge of citizens and economic factors in the area, emissions and gas taxes are not recommended as particularly viable policy options. Thus our recommendations for mobile-source emission reduction are ranked from best to worst as: tradable permits, cash-for-scrappage, enhanced I/M, and conservation marketing for marine vessels.

Please contact the author for complete manuscript.

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